BOTANICAL PAPERS AT BUFFALO.[1]

BOTANICAL SOCIETY OF AMERICA.

CONWAY MACMILLAN: *On the distribution of plants in a fresh-water insular region.*—The locality studied was Lake of the Woods, with its thousands of islands, varying in size from mere rocks to areas hundreds of square miles in extent. A general survey of the geological conditions shows that drift is sparingly distributed. According to vegetation the following types of islands were noted: (1) floating bog islands, (2) Scirpus and Phragmites islands, (3) sand dune islands, (4) irregular creviced-rock islands, (5) dome-shaped rock islands, with or without drift sheets.

The strand flora was discussed as (1) beach formation and (2) shore formation. In the beach three areas or zones of distribution were defined: (*a*) front strand, (*b*) mid strand, (*c*) back strand. Strand pools with concentric zones of vegetation were described as a feature of mid strand. Three types of strand vegetation in general were defined: (*a*) Cornus strand, (*b*) Salix strand, (*c*) Prunus strand. A discussion of the conditions under which beach formations arose was given, with reference to drift distribution and wave action.

The shore formations were discussed briefly, attention being given to surf plants, such as Scirpus, Phragmites, and Spiræa salicifolia. Gullies crossing a strand or shore, and the change in the distribution of shore plants consequent upon their existence, were described in outline.

It was shown that the islands with rock cones could be classified either as irregular or as dome shaped. The latter showed a remarkable zonal distribution of plants due to gradual soil-formation and the silting off of the soil in a regular way towards

[1] In almost every case the abstracts given have been prepared by the authors.

the periphery of the islands. The following zones were described from periphery to center: (1) shore zone, (2) outer shrub, (3) tree zone, (4) inner shrub, (5) central meadow or central shrub In islands in which the soil formation was recent the zonal distribution was shown to be distinct, but in older soiled islands, where the soil had become thick, it was shown that the central meadow at first becomes a central shrub and, finally, with the addition of further soil layers, a central tree formation is developed. Zonal distribution is still evident in islands with thick soil sheets, for the peripheral tree formation is made up of older individuals than occur at the center of the island. If, however, the rock surface is very irregular, this zonal distribution cannot appear, and the island in such a case is commonly clothed with a pretty uniform coniferous formation.

It was shown that after burning off an island zonal distribution will reappear in the new plants established only when the soil is thin; when it is thick the whole island is uniformly tenanted by light seeded species such as willows, poplars, and epilobiums.

The two basal forms of islands, the irregular and the dome-shaped, may be considered as combining and forming the variously shaped larger islands of the region. All islands can be explained in terms of these. Slope, contour, strike, and bedding of country rock, disposition of talus masses, direction and width of crevices, and formation of gullies, were discussed as influencing the general distribution of the plants, and attention was directed to the influence upon vegetation by proximate islands which modulated the wave action upon a given shore.

Zonal distribution on land is quite as evident in these areas as is the zonal distribution in lakes described by Mangin and others. The paper was illustrated by numerous lantern slides.

N. L. BRITTON: *An Eleocharis new to North America.*—In the Alaskan collections of Thomas Howell an Eleocharis was found which proves to be a species hitherto known from Japan. It is remarkable for its very large tubercle, which exceeds the

achene itself in length and breadth. In this regard it resembles the one or two large tubercled North American species already known, but it belongs to a different section of the genus, and its other American associates show no such character. It was suggested that the function of such tubercles (enlarged style bases) may be to give buoyancy to the achene in water.

GEORGE F. ATKINSON: *Some problems in sporophyll transformation among dimorphic ferns.*—In *Onoclea sensibilis*, the sensitive fern, abnormal spore-bearing leaves are sometimes found. This form is intermediate in character between the fertile and sterile leaves of the normal form of the species, and has been regarded at different periods as a distinct species, a variety, or an abnormal state caused by the contraction of the vegetative leaf. Experimental evidence shows that the form is produced by an unfolding and extension of the young sporophyll before its characters as such are fully determined, and is caused by a complete or partial loss of the vegetative leaves through injury. Cutting off the vegetative leaves in May and again in June resulted in a large number of these abnormal forms, together with examples of apospory. These results were briefly reported at the Brooklyn meeting of the A. A. A. S. in 1894.

The experiments were continued in 1895 on another species of the genus, *Onoclea Struthiopteris*, with identical results in the transformation of the sporophyll, though no cases of apospory were observed. During the same year experiments were begun on *Osmunda cinnamomea*, but as the fertile leaf has the sporangia formed in the autumn, and since they appear along with the sterile leaves in early spring, no results were obtained that season. During 1896 there were a few cases of partial sporophyll transformation, but the results were not marked since the injury to the vegetative leaves was introduced while they were very young and long before the incipient development of the sporophyll of the succeeding year. In 1896 the vegetative leaves were cut in July and again in August, and marked results will be looked for the coming year.

A peculiar transformation sometimes occurs in this same species, which gives rise to the form *Osmunda cinnamomea frondosa*. My attention was first called to this by Mr. C. D. McLouth of Muskegon, Mich., who has furnished me with considerable material. The transformation is peculiar, in that it appears to be an increase in the leaf surface along the mid-vein of the sporophyll, and also along the mid-vein of the pinnæ, so that the sporangia are borne on wing-like expansions. The locality where these forms were collected gave evidence of a fire, either in the late autumn or early spring, and the forms were very marked and abundant near dead stumps where the fire was the hottest. Since at this season of the year the sporangia are nearly all formed, the nature of the transformation would be different from what it would be if the vegetative leaves were destroyed during midsummer, when the sporophyll was in the incipient stages of development. It is also possible that the heat penetrated far into the stem of the plant and may have introduced disturbing factors of quite a different nature from that of the loss of the carbon assimilating members, which results when the leaves only are cut away.

Experiments at different seasons will be conducted in the hope of arriving at the fundamental laws operating in these cases. A large number of lantern slides made from photographs illustrated the paper.

L. H. BAILEY: *The philosophy of species making.*—This paper will be published in full in an early number of the BOTANICAL GAZETTE.

SECTION G OF THE A. A. A. S.

D. T. MACDOUGAL: *The relation of the growth of leaves to the CO_2 of the air.*—The leaves of seedlings accomplish a large proportion of their development but not always their entire development at the expense of food derived from the seed. Rapidly developing but small leaves furnished with large stores of reserve food are able to carry out a complete development, but are

unable to endure continued existence in an atmosphere free from CO_2. The slowly developing leaves of many woody perennials develop normally and endure long continued existence under the above circumstances. This varying reaction of leaves is dependent upon a series of conditions which may be included under the title of "availability of the food supply." The death of a leaf in an atmosphere free from CO_2 is due to insufficient nutrition, and not to the pathological effects of disintegrated chlorophyll.

R. N. DAY: *The forces determining the positions of leaves.*— Epinasty and hyponasty are inherent properties of leaves, whose reactions may be suppressed but not altered by external conditions. Dorsiventral leaves are diaheliotropic, diageotropic, or apogeotropic, epinastic or hyponastic. The predominating force in every instance is the heliotropic tendency, which suppressed other reactions. The position of the leaf is a physiological, not a mechanical, resultant, and cannot be expressed by the parallelogram of forces as proposed by Krabbe in 1889.

N. L. BRITTON: *On Cratægus coccinea and its segregates.*— The necessity of observing living forms in various stages of growth was pointed out. Typical *C. coccinea* is known by its cordate leaves, moderately glandular inflorescence, etc. Occurring with it, and lost sight of, has been *C. rotundifolia*, with smaller oval or oblong leaves narrowed at base, larger flowers, a densely glandular inflorescence, and a different time of blooming. Other segregates are *C. flabellata*, a northeastern species, with leaves narrowed at base and more incised; *C. macracantha*, the species with smallest fruit; and *C. mollis*.

L. M. UNDERWOOD and F. S. EARLE: *The distribution of the species of Gymnosporangium in the south.*—This paper appears in full in this number of the BOTANICAL GAZETTE.

L. H. BAILEY: *Morphology of the Canna flower.*—The author called attention to the prevailing asymmetry in the Scitamineæ,

and remarked that groups of plants which show marked irregularities in form are nearly always fertile subjects for plant-breeding. The most nearly symmetrical flowers of this order are found in the banana tribe, in which five stamens are present and the sixth is represented by a sterile filament. He exhibited a banana fruit to show its five-angled form, and remarked that it is probable that somewhere in its phylogeny this fruit had lost its symmetry. He also called attention to the three seedless loculi of the fruit, and remarked that although the plant is seedless, it still varies or it is the subject of evolution, thus discrediting Weismann's hypothesis that all progressive or permanent variation arises through sexual union.

In the ginger tribe the stamen is reduced to one normal member. In the canna tribe the stamen is represented by what is apparently but a single loculus of the anther, the other loculus being apparently developed into a foliaceous organ. The remaining stamens are represented by petal-like staminodia and these members make up the showy part of the flower. The speaker exhibited specimens of canna flowers, and also charts, to show the very marked evolution in the form and size of the flower, and more especially of the staminodia, and the gradual increase in the size of the petal-like appendage of the one fertile stamen. There seems to be a considerable decrease in seed production in the modern cannas as compared with the types of a generation and more ago, and this decrease is probably associated with less pollen, or less efficient pollen, in the modern flowers. This tendency toward seedlessness is seen in many cultivated plants, of which the potato is a good example. Since new varieties come mostly from seeds, many persons have supposed that plant-breeding must eventually cease in these plants; but the speaker pointed out that the constant choice of seeds for sowing is itself a powerful agent in conserving the seed-producing power of the plant. So long as we select seeds, so long may we expect the effects of this selection to give seeds in at least a part of the individuals of every generation.

E. L. MOSELY: *A comparison of the flora of Erie county, Ohio, with that of Erie county, N. Y.*—Both districts are adjacent to Lake Erie, but the Ohio district (including Erie county and the peninsula and islands of Ottawa county) contains 265 native species of phanerogams not known to occur within fifty miles of Buffalo. The cause is mainly climatic. The average date of the last killing frost in spring at Sandusky is April 30, at Buffalo it is May 20; the first killing frost in autumn at Buffalo is September 15; at Sandusky it is October 24; and the summer is decidedly cooler at Buffalo. Reasons for the difference in climate were given, including the blowing of the ice to the east end of the lake in spring and other considerations.

CHARLES E. BESSEY: *The significance of the compound ovary.*—In the study of the gynœcium of angiosperms we are forced to conclude that its primitive condition was apocarpous; in other words, that whether monocarpic or polycarpic there was at least no union of ovary with ovary. The original ovary was doubtless simple. By a comparative study of the ovaries of existing plants we are led to the conclusion that the syncarpous gynœcium was derived from the apocarpous gynœcium. This is so plain that it is needless to dwell upon it. Both phylogenesis and ontogenesis furnish us with numerous illustrations of the truth of this statement.

It is to be observed that the compound ovary is a comparatively stable structure, and that it changes slowly within any natural group, or in passing from group to group. No part of the plant is more stable, yet with all its stability it undergoes changes in certain directions. It is a common occurrence to find a pentacarpellary ovary reduced to four, three, or two carpels, and this may proceed until, as in some of the Caryophyllaceæ, we seem to have but one carpel remaining. In rare cases there appears to be a reversion from syncarpy towards apocarpy, as in the Apocynaceæ and Asclepiadaceæ, but as a rule it may be said that syncarpy once attained by a group is persistently maintained, however much of simplification it may otherwise have undergone.

The ultimate development of the compound ovary is in the direction of a simplification of structure. Thus the many carpels of most Thalamifloræ and Heteromeræ are gradually reduced to the two carpels of the Bicarpellatæ. In the Calycifloræ the Rosales and Myrtales have generally several to many carpels, while in the Umbellales there are but two. Likewise in Inferæ the ovary in the lower group, Rubiales, has more carpels than we find in the highest group, Asterales. A similar simplification occurs in the monocotyledons, as we pass from the Coronarieæ to the sedges and grasses. This simplification of structure results in increased paternal care of the offspring. Thus while many embryos are to be nourished in the earlier cases, there are but one or two in the later. The biological significance of this result is so well known as to need no discussion here.

When we come to an application of what we know of the compound ovary to systematic botany, it appears to me that the following conclusions are warranted: (*a*) the apocarpous plants are to be regarded as lower than those which are syncarpous, and in a natural arrangement the former must precede the latter; (*b*) we must carefully distinguish between ovaries which are primitively simple, and those which have become simplified from a more complex structure, in which cases the first indicate a lower, and the second a higher position in the natural system; (*c*) grasses, sedges, etc., in which the ovaries are simplified from the compound type, are not the lowest of the monocotyledons; (*d*) willows, oaks, walnuts, etc., with their apparently simple flower structure, are not to be regarded as among the lowest of the dicotyledons.

H. L. Russell: *On the bacterial flora of cheddar cheese.*— The paper presented a quantitative delimitation of the bacteria in cheddar cheese from the time it is first made until it has been thoroughly broken down. The botanical changes are divided into three stages, as follows: (1) period of initial bacterial decline, (2) period of bacterial increase, (3) period of final decline. As

to changes in different species it is found that the lactic acid bacteria develop to an overwhelming degree while the gas bacteria and the peptonizing germs are gradually destroyed.

CHARLES R. BARNES: *Terminology of reproduction and reproductive organs.*—Two points were discussed, which are not directly related:

(1) The distinction between vegetative and non-sexual reproduction. The reproduction of the earliest plants was undoubtedly vegetative reproduction. Non-sexual reproduction is not fairly differentiated from it until the Bryophyta are reached, and with them a clear alternation of generations. In Bryophyta, Pteridophyta, and Spermatophyta, the forms of vegetative reproduction, viz., by brood buds or gemmæ, by detached shoots, and by proliferation (with detachment late when it occurs at all) are clearly distinguishable from the non-sexual form, viz., by spores produced in a compound sporangium. The fundamental distinction lies in this, that vegetative reproduction *repeats the same phase*, while non-sexual reproduction*gives rise to the alternate phase*.

(2) The classification of sporangia and gametangia into *simple* and *compound* was suggested. The simple gametangium or sporangium is one consisting of a single cell whose contents become respectively the gametes or the spores. The compound gametangium or sporangium is an aggregate of several or many (rarely reduced to one) simple gametangia or sporangia surrounded by one or more layers of sterile protective cells. Oogonia and carpogonia are simple gametangia, archegonia are compound gametangia. Simple sporangia occur below Bryophyta; compound in Bryophyta and above.

BERTHA STONEMAN: *A comparative study of the development of some anthracnoses in artificial cultures.*—Different species of Glæosporium and Colletotrichum, and the allied genera Vermicularia and Volutella, present in artificial cultures distinct characters varying to a certain extent with varying conditions of light, temperature, and nutrient media. Under uniform conditions of

growth the characters have been found sufficiently constant to be of value in distinguishing or uniting species whose similarity in morphological structure or variations resulting from the character of the host would render their systematic position uncertain. Of about thirty species studied, five Colletotrichums and two Gloeosporiums have been definitely connected with an ascigerous form, the transition from one stage to the other occurring without the intervention of a pycnidial stage. The ascigerous stages of each, two of which have been found as saprophytes in nature, bear a close resemblance to each other and would fall in a genus near Gnomoniella.

W. W. ROWLEE: *The development of the vascular elements in the primary root of Indian corn.*—In many text-books the large cells in the central portion of the root-tip are described as the rows of cells from which the vessels are developed.

Investigations prove that these larger cells pass over into parenchyma and that the protoxylem is differentiated from cells radially opposite and nearer the surface than these.

JOHN M. COULTER: *Some remarks on chalazogamy.*—The use of chalazogamy as a basis of classification was first discussed, reasons against such use being the unnatural associations and separations, the use of a single character for important groupings, the fact that chalazogamy has to do not with a differentiated organ but with a process. The use of chalazogamy as an indication of phylogeny, as suggested by Nawaschin, was also discussed, the view that it is an intermediate stage in the adaptation of a gymnosperm-trained pollen-tube to the traversing of angiosperm cavities being objected to. It was shown that the necessity of "adaptation to cavities" was by no means so great as generally supposed, and that chalazogamy is more suggestive of being an occasional modification of porogamy than an antecedent condition. In regard to the significance of chalazogamy the speaker claimed that it is purely physiological, and does not involve any such change in structure as will define a natural group

or indicate a line of descent. The route of the pollen-tube is dependent upon mechanical obstruction, nutritive material, possibly chemiotaxis, and this route may or may not include the micropyle, quite independent of plant affinities. Illustrations were given showing that chalazogamy is favored by a closed micropyle region, and by unfavorable position of the micropyle associated with favorable structure of the ovule, such as well-developed sterile macrospores.

L. M. UNDERWOOD: *The habitats of the rarer ferns of Alabama.*— The state of Alabama is especially interesting to the students of the pteridophytes (1) from the fact that it represents the southern limit of a number of species of the Appalachian district which follow the spurs of the mountains well into the interior of the state, and on the other hand the northern limit of several of our subtropical species; (2) because of the remarkable *Trichomanes Petersii* found only within its borders; and (3) because it contains the only station where the rare *Asplenium ebenoides* has been found in any quantity. The state has a comparatively large pteridophyte flora, including some forty species of ferns besides at least five species of Ophioglossaceæ, having been well explored by Judge Peters, Professor E. A. Smith, and Dr. Charles Mohr. We have been able to add one species (*Dryopteris Floridana*) to the list, and to rehabilitate one of the early species of Botrychium, *B. bipinnata* (Lam.), which is clearly distinct from *B. ternatum*, with which it has been confused for many years, largely because of the deficiency of collectors through the southern country.

A visit to the original station of *Trichomanes Petersii* has given some new points in regard to its habit and habitat. Likewise a visit to the out-of-the-way ravine in Hale county has enabled us to show the absurdity of regarding the rare *Asplenium ebenoides* as a hybrid. This species, far from possessing the habit of either of its supposed parents, is entirely distinct, and is more closely allied in its habit to its congeners, *A. pinnatifidum* and *A. montanum*. It is evidently a very old species, of which the pres-

ent station doubtless contains the largest remnant of its former wide distribution.

FRANCIS RAMALEY: *On the stem anatomy of certain Onagraceæ.*— Seven genera of the disintegrated genus Œnothera, represented by thirteen species, were examined, with the following conclusions. There seem to be no marked anatomical characters of the stem which can be set down as belonging to one species and to no other. Plants of the same species growing under different conditions may present as great differences as are to be noted between species of comparatively remote genera. Slight differences in the thickness of the various zones of tissue are evident, as are also variations in the size of the constituent elements in some of the tissues. The following generalizations may be drawn: (1) there is a striking similarity in stem structures throughout all the genera examined, and stem anatomy will not serve to distinguish one genus from another; (2) the cortex is absent from old stems, being replaced by cork of characteristic structure; (3) the normal phloem is in all cases poorly developed; (4) bicollateral vascular bundles occur in all the species examined; (5) intra-xylar phloem islands are found in the stems of all the robust species; (6) raphides of calcium oxalate are present in all cases, generally occurring in both cortex and pith, often in the pericycle and phloem.

CHARLES E. BESSEY: *The point of divergence of monocotyledons and dicotyledons.*— In discussing this question I assume that it is unnecessary to bring forward proofs as to the common origin of the two subclasses, Monocotyledonæ and Dicotyledonæ. It is possible, but in my opinion improbable, that some plants are now included in them which have had an independent origin, but all will agree that after making the most liberal subtractions possible the two subclasses must still remain as two very closely related groups, with essentially the characters now assigned to them. We must bear in mind the well-known biological law that, in general, the relationship of allied groups is most marked between their lower members, that is, between those members

which represent the primitive types, and that it is less marked between the higher members of the groups. In other words, we recognize the fact that groups diverge as they are evolved. If we represent the phylogenesis of plants by lines, we are compelled to arrange these lines so that they show repeated series of divergencies.

Another law which must be kept in mind, also, is that evolution for the most part has proceeded from the simple to the complex. The simpler plants of today represent to a large extent the types of the primitive plants of former periods, from which the complex plants of today were derived. In this connection, however, we must not overlook the fact, as pointed out elsewhere,[2] that in the evolution of the successive members of groups of plants there has often been a simplification of structure. Thus we often find apetalous derivatives from polypetalous types; bicarpellary ovaries from polycarpellary types; one-celled, one-seeded compound ovaries from several-celled, many-seeded ovaries. But there is a great difference between these simplified structures which have been derived from more complex structures, and those which are primitively simple. The former are nearer the end of a lengthened genetic line, the latter are nearer its beginning.

When we apply these principles to the system of Bentham and Hooker we find no contact points whatever between monocotyledons and dicotyledons. The lower monocotyledons are very unlike any of the Apetalæ. What similarity, for example, is there between the grasses and sedges, on the one hand, and the oaks, walnuts, and plane trees, on the other. It is only when we pass up to the Apocarpæ in the monocotyledons and to the Micrembryeæ, and possibly Piperaceæ of the latter, that there are many similarities of structure. To this I must refer later, and need only say here that evidently the authors made no attempt to indicate by their arrangement of families any contact point between the monocotyledons and dicotyledons.

[2] Evolution and Classification. Proc. A. A. A. S. **42**:237. 1894, and The significance of the compound ovary, presented at this meeting.

In the system of Engler and Prantl one might look for such a disposition of the families of the two subclasses as to indicate a common point of origin, but in this we are disappointed When we compare the structure of the families placed at the beginning of the monocotyledons, Typhaceæ, Pandanaceæ, Sparganiaceæ, Potamogetonaceæ, Naiadaceæ, Aponogetonaceæ, Alismaceæ, etc., with those occupying a similar place in the dicotyledons, Saururaceæ, Piperaceæ, Chloranthaceæ, Lacistemaceæ, Juglandaceæ, Myricaceæ, Leitneriaceæ, Salicaceæ, etc., it is at once evident that here there is a great gulf between the two subclasses. It is becoming more and more evident that this system which promised so much is little better as an expression of genetic relationship than the system of Bentham and Hooker, which it is now displacing. Its so-called lower families are for the most part composed of plants not with a simple, that is, a primitive structure, but a simplified structure. As a rational system, designed to express our ideas of genetic relationship, it is sadly disappointing.

It is evident that we must cease to confuse the simplified with the primitively simple structures, and that in the latter alone can we find the point of divergence of the plants of the two subclasses under consideration. It is only when we do this that we are able to construct a system which shall suggest to us the solution of the problem. Our system must begin with simple pistils, not compound pistils; with really simple and not simplified pistils. It matters little whether the flowers are perfect or not; whether they have many or few flower-leaves or even none at all. We have learned that these are minor matters and that they change very readily even within narrow limits.

In accordance with these principles we may readily fix upon the apocarpous monocotyledons (Bentham and Hooker's Apocarpæ) as the representatives of the primitive members of this subclass. This structure will readily suggest the Ranales among the thalamifloral dicotyledons, and a closer examination shows a remarkable similarity of structure, in not only the reproductive but also in the vegetative organs of the plants of these two

groups. After some years of study given to a comparison of these groups I am more firmly convinced than ever of their genetic relationship. They show their relationship in their gross anatomy, the histology of their tissues, and their embryology.

Allied to the Ranales are the Rosales, beginning with the Ranunculus-like Potentilleæ, and passing by easy steps to the simpler Leguminosæ (Cæsalpiniaceæ and Mimosaceæ), on the one hand, and the Saxifragaceæ on the other, and through the latter to Celastrales and Myrtales. Here, then, in my opinion, is the point of divergence of the monocotyledons and dicotyledons, represented by the Apocarpæ of the former, and the Ranales and Rosales of the latter. The similarities in structure between some Microspermæ and the Naiadaceæ in Bentham and Hooker's system, noticed above, as between some of the families (Naiadaceæ, Alismaceæ, Chloranthaceæ, etc.) placed by Engler and Prantl at the beginning of the two subclasses, are hints as to a natural arrangement which it is strange that these eminent systematists overlooked.

L. M. UNDERWOOD and F. S. EARLE: *Notes on the pine inhabiting species of Peridermium.*—The paper gave an enumeration of the species known to inhabit the various species of Pinus in the United States, with their distribution by hosts, and their geographical distribution. All the species are foliicolous except *P. cerebrum* Pk., which forms large distortions on the stems, trunks, and branches of its hosts. Remarks were made in reference to the various forms of these distortions, especially those produced in the south on *Pinus Tæda* and *P. echinata*. The species being perennial, the necessity of an alternate stage for the parasite is obviated.

D. T. MACDOUGAL: *Reaction of leaves to continuous rainfall.*—The first recognition of the influence of rainfall upon leaf forms was that given by Ridley in his *Flora of Pajang*, and an extensive exploitation of the subject was made by Stahl in 1893. Since the publication of Stahl's work, Jungner has carried on a

great amount of observational work of doubtful value, and has made some attempts to produce rainfall characters in leaves experimentally. The hitherto recognized rainfall characters are as follows: attenuated apices, entire margins, a glossy appearance of the upper surface, ready adhesion of water to the upper surface, deepened furrows above the ribs, pendent positions of the laminæ, and enlargement of the pulvini. It is to be noted, of course, that in no one species do all of the above characters appear, and Jungner has been able to induce only the glossy appearance, adhesion of the upper surface to water, and the pendent position of the laminæ in a few of the many species tested.

During the past year I have carried out such a series of experiments with *Arisæma triphyllum*, *Trillium erectum*, and *T. recurvatum*. In the trilliums the pendent positions of the laminæ, the glossy appearance of the upper surface, and a reduction of the marginal teeth were obtained. In Arisæma, the glossy appearance, adhesion to water of the upper surface, a marked reduction of the truncate marginal teeth, and a deepening of the furrows above the ribs were obtained, and, in addition, the laminæ of this species assumed an upwardly convex form after exposure to rainfall continuously for twelve days. This must be considered as a new rainfall character, and is not to be identified with the rolling and twisting of leaves grown in a spray of cold water. In an attempt to distinguish the characters to which the glossy surface was due, it was found that in the normal leaf the external ends presented an outwardly papillose extension, giving a velvety appearance. In the rainfall leaves the outer wall of each cell was distinctly flattened. The smoothness of the upper surface is doubtless the principal factor in its adhesion to water, though it is entirely possible that chemical alterations in the outer wall have ensued. The results may be summarized as follows: (1) the determination of a new rainfall character, the upward convexity of the laminæ; (2) alterations in leaf margins; (3) inferentially, that the rainfall characters which may be induced experimentally are not identical, but rest upon the individuality of the species.

MARY A. NICHOLS: *Studies in the development of the ascospores in certain Pyrenomycetes.*—The paper contained an account of the early stages in the development of the ascigerous fruit in certain spheriaceous Pyrenomycetes. The observations relate specially to the question of sexuality, and point to the conclusion that a sexual process may be present in some member of the family and absent or very degenerate in others. Thus, in *Ceratostoma brevirostre* the origin of the ascospore is distinctly traceable to a fusion of differentiated gametes, while in Teichospora only possible rudiments of antheridia are present. The successive stages from the formation of the oosphere to the maturation of the ascospore reveal a process of development somewhat different from any heretofore suggested, but analogous to the development in Sphærotheca, as observed by Harper, and also somewhat similar to that in the Florideæ.

W. W. ROWLEE: *The stigma and pollen of Arisæma.*—The paper described the androœcium and gynœcium of *Arisæma triphyllum* and *A. Dracontium.* The peculiarities noted were the consolidation of the stamens, the open style with the stigmatic papillæ not only on the surface of the stigma but also on the inner surface of the tube and forming a stigma-like tuft on the inner surface of the ovary. The pollen in one case was found to have already germinated within the anthers, and the tubes had folded back and forth upon themselves. Other cases examined did not show the same growth.

N. L. BRITTON: *Notes on the genus Amelanchier.*—Among the eastern forms, *A. Canadensis* can be distinguished easily from the rest, and is Appalachian and Canadian in distribution; *A. Canadensis obovalis* belongs to the coast and Great Lakes; *A. spicata* is a very low mountain species; and *A. rotundifolia* extends from Maine to the Saskatchewan. Among the western forms, *A. alnifolia* is reported from northern Michigan, but its occurrence so far east is doubtful, its eastern limit being rather from Nebraska to Manitoba; *A. Utahensis* ranges from Utah to

Arizona; *A. florida* occurs in Oregon and Washington; and *A. Pringlei* in Mexico.

ALEX. P. ANDERSON: *On the formation and distribution of abnormal resin ducts in conifers.*—By some extended work on the occurrence of normal and abnormal resin ducts in conifers the author found: (1) annual rings of *Pinus silvestris* and *Picea excelsa* containing frost rings have in cross sections fewer vertical resin ducts per square millimeter than the normal rings; (2) regulatory tissue in hyponastic branches of *Pinus silvestris* has in cross sections fewer resin ducts per square millimeter than the opposite side of the branch; (3) in *Abies pectinata* affected with *Æcidium elatinum*, (*a*) the resin ducts in the diseased bud-scales are more irregular in their form and contain fewer epithelium cells than the normal, (*b*) the fungus mycelium is never found in the resin duct canals, nor in the epithelium layer of cells surrounding the canals, (*c*) abnormal resin ducts are always found in the wood of the thickened portion of the diseased branch; (4) in *Pinus Strobus* diseased at the roots with *Agaricus melleus* Vahl, an increase in the number of resin ducts of the wood takes place in the whole plant above the diseased part; (5) in the wood of branches of *Abies pectinata* diseased with *Phoma abietina* Hartig abnormal resin ducts are found only above the constricted portion of the branch; (6) the same phenomenon as just mentioned occurs when young seedlings of *Abies pectinata* are diseased with *Pestalozzia Hartigii* Tub.

ARMA A. SMITH: *The development of the cystocarp of Griffithsia Bornetiana.* — Published in full in the July number of the BOTANICAL GAZETTE.

L. M. UNDERWOOD: *Notes on the allies of the sessile Trillium.*—Several species of Trillium have been confused apparently under this name. Even Linnæus included under this name at least two species which had been well figured before his day, the one by Plukenet and the other by Mark Catesby. One of these

species, which is very distinct from the ordinary *T. sessile* in the states bordering the Ohio river, has been collected and studied in central Alabama during the past spring. It is a robust species with highly variegated leaves of at least three striking and distinct shades, and is well worthy of cultivation for its rich, velvety foliage, to say nothing of its large and rather handsome red flower. The species seems to have remained since Catesby's time without a name other than the polynomial he gave it. Other southern and southwestern species, as well as an equally remarkable series of species from the Pacific coast, have been unceremoniously and unnaturally combined under this name by American botanists, or barely separated as varieties or "forms." A revision of the group is badly needed. Attention was also called to a series of forms representing the earlier stages of the plant, and the study of post-embryonic stages was urged as a means of determining relationships.

C. L. POLLARD: *On an apparently undescribed Cassia from Mississippi.* — A remarkable Cassia, allied to *C. Chamæcrista*, but distinguishable by its virgate habit and strict pods, collected in northern Mississippi by Professor S. M. Tracy, proved, upon cultivation, to warrant its separation as a distinct species, to which the author proposes to give the name of the discoverer.

B. M. DUGGAR: *A bacterial disease of the squash-bug* (*Anasa tristis*).— Some squash-bugs kept for experimental purposes were found to be dying in considerable numbers, in an apparently healthful environment. The disease was readily passed on to other bugs. The distressed insects became sluggish, and very weak, and finally died, the body becoming a mass of gruel-like fluid. Cultures were made from dead insects upon various nutrient media, agar-agar, bouillon, gelatin, milk, etc., giving colonies of a bacillus. Inoculation of this bacillus produced the disease in healthy bugs. Infusions of different cultures were found to have characteristic toxic properties. Bugs placed in these infusions died with every symptom of distress. Prepara-

tions of the blood of diseased insects showed a short bacillus, single or in pairs. The tissues of the insects break down under the growth of these organisms, which probably enter insects through the spiracles.

C. R. BARNES: *What is bark?*— The varying use of this term suggests a consideration of how it should be used by American botanists. *Borke* and *Rinde* have been used by German botanists to denote respectively the external tissues of the root or stem which dry up, and the entire mass of tissues outside the cambium. In this usage, which has been tolerably consistent, they have been followed by the English. American popular usage, and scientific usage except as modified by foreign influence, assigns the name *bark* to the *Rinde* of the Germans. But *Borke* has been translated *bark*, while *Rinde* is translated *cortex* in the English editions of various German text-books. The author advocates the use of *bark* to designate the whole mass of tissue outside the cambium, while *cortex*, with suitable qualification, is used to designate certain parts of the bark. In this usage Americans are sustained by French botanists.

JOHN M. COULTER: *Structures of the embryo-sac.* — Attention was called to recent observations which showed a certain amount of variability in these apparently constant structures. These observations were supplemented by studies in Salix and the Compositæ. The results were summed up in the form of definitions of the three embryo-sac regions as follows: (1) *the egg-apparatus* consists of two or three usually naked cells, the oosphere and one or two synergids together representing a single archegonium, of which the synergids may represent canal cells; (2) *the primary endosperm cell* is formed by the fusion of two vegetative cells (the polar cells), which process holds no relation to a sexual fusion and is stimulated normally by the act of fertilization to continue the vegetative development of the gametophyte, just as the adjacent sporophyte structures are stimulated to develop seed and fruit; (3) *the antipodal cells* are variable in number

(two to seventeen observed), evanescent or persistent, representing the vegetative region of the gametophyte not dependent upon fertilization for its development.

Embryos have been observed to develop both from synergids and in the antipodal region, and such may be regarded as arising through apogamy.

N. L. BRITTON: *Some Cyperaceæ new to North America, with remarks on other species.*—*Cyperus cylindrostachyus*, of the Old World tropics, has been introduced into the southern states, and is *C. cylindraceus* Chapman; *C. thyrsiflorus*, a Mexican type, extends into southern California; the Asiatic *C. pumilus* has been found introduced into Florida and Alabama. As waifs may be mentioned the Asiatic *C. congestus*, found at Painesville, Ohio; *C. glaber*, of southern Europe, found in Massachusetts; and *C. comosus*, of Greece and the Levant, found on ore heaps at South Bethlehem, Penn. The Cuban *Scirpus camptotrichus* has been found by Dr. Mohr as a native plant near Mobile. The author has also satisfied himself that the African *C. aristatus* is not the American plant so often bearing that name, and that the latter should retain its old name *C. inflexus*.

L. H. PAMMEL: *Grasses of Iowa.*—The paper contained a description of the topography of the state, and presented a list of the grasses. The grass flora is not diversified, containing fewer species than are to be found in any adjacent state. Among the species are noted twenty-nine species as from the north, forty-six from the south, eleven from the west, thirteen extra-continental, and fifty-five introduced.

W. A. KELLERMAN: *Ceres-pulver: Jensen's new fungicide for the treatment of smut.*—In 1890 Kellerman and Swingle published an account of successful experiments with potassium sulfid (liver of sulfur) as a preventive of smut of wheat and oats. This, according to J. L. Jensen, was the starting-point (*Ausgangspunkt*) for his *Ceres-pulver*. The exact composition of the

fungicide is not given but it consists mainly of potassium sulfid. Other important ingredients are, according to Jensen, also added. He manufactures the ingredients and they are doubtless of purity superior to those usually kept in drug stores, and probably not too expensive, considering the quality.

The method of application is wholly different from that employed by myself and Mr. Swingle. I can, after trial, highly recommend it. A solution is made by dissolving 2 lbs. in 125 liters of water. This is intended for 1000 lbs. of seed. It is poured on the seed grain by means of an ordinary watering can, the mass at the same time being shoveled over and over on a tight floor, so that the solution may come in contact with every grain.

The stirring of the heap of grain is repeated twice daily, the sowing to be done four or five days after the treatment. The heating will not be detrimental if the mass of grain is not more than six or eight inches deep. The initial stages of germination, which will be entered upon, are claimed to be of decided advantage.

My own experiments with this fungicide, though not yet completed, show that it is remarkably efficient and that it justifies the claims made for it by the originator.

N. L. BRITTON: *On the cardamines of the C. hirsuta group.*—*C. hirsuta* was distinguished from related species and regarded as probably a native of eastern North America, and not necessarily a marsh plant. *C. Pennsylvanica* Muhl., the most common form, is a tall leafy species, with elongated leaf segments, pods narrower than in the type, and is a bog and marsh plant. *C. parviflora* L. is a rock species of the mountains, and extending west to Lake Superior. It is a slender form with narrow leaf segments, and zigzag stem. *C. flexuosa*, a mountain species, is broadly leafy, with wide leaf segments, and pedicels shorter than in *C. Pennsylvanica* and pods two to three times as broad. *C. arenicola* is a species of the sand plains, from southern New England to New Jersey, Ohio, and from the Gulf states to Texas. It is rigidly erect, with narrow leaf segments and strictly erect pods.

JOHN K. SMALL: *The relation between the genera Thysanella and Polygonella as shown by a hitherto unobserved character.*—*Thysanella fimbriata*, the only representative of the genus, has persistently and apparently without reason been referred to the genus Polygonum. Its habit and morphology does not suggest Polygonum at all but strongly resembles that of Polygonella. The floral structure in Thysanella approaches more closely the conditions we find in Polygonella than anything known to exist in the genus Polygonum.

Another character possessed by both the genera in question, and one never mentioned in this connection, is the internodal branching. In all other members of Polygonaceæ the branches arise from the nodes; in Thysanella and Polygonella the branch or branchlet, as the case may be, is united to its primary axis often to beyond the middle of the internode.

JOHN K SMALL: *An apparently undescribed species of Prunus from Connecticut.*—This species is related to *Prunus maritima* and occurs in the immediate neighborhood and under precisely the same conditions. It is lower than the beach plum, more slender and delicate in habit, maturing its fruit earlier and losing its leaves earlier in the fall. The following differences from *P. maritima* may be noted: (1) the leaf is orbicular instead of elliptic or oblong; (2) the flowers are smaller with shorter and broader calyx-segments; (3) the drupe is smaller, always globose, and short pediceled; (4) the stone is smaller and more turgid (nearly as thick as broad) and pointed only at the base, while that of the common beach plum is flattened, more elongated, and pointed at both ends.

JOHN K. SMALL: *The flora of the summits of King's mountain and Crowder's mountain, N. C.*—The following phenomena may be noted: (1) the rare fern *Asplenium Bradleyi* is very common on the slopes and extends to the higher points; (2) normally large forest trees appear as small shrubs although the altitude is not great, and in this extremely stunted state produce abundant

fruit; (3) the vegetation is shrubby with the exception of two perennial herbs, a fern and a sedge; (4) the occurrence of *Quercus nana* in the summits extends the geographic range of that species several hundred miles in an unexpected direction; (5) almost one-half of the shrubby plants on King's mountain are ericaceous, and the range of one, *Rhododendron Catawbiense*, is extended far to the east and in addition the station is at a much lower altitude than any at which the species has hitherto been known to occur; (6) although the summit of King's mountain is much smaller and some feet higher than that of Crowder's mountain it harbors six more species, chiefly shrubby.

DAVID F. DAY: *Parthenogenesis in Thalictrum Fendleri.*—In 1883 a seedling of *T. Fendleri* was sent home from Colorado for cultivation. In late May it flowered and proved to be pistillate. About the last of August it presented abundant and good seed, although no staminate plants of any species of Thalictrum were in the neighborhood. The seeds were planted and yielded abundantly staminate and pistillate plants. Staminate plants have been artificially prevented from maturing flowers almost every year since. At least eight times in the thirteen years the pistillate plants have produced good seed in abundance. Plants were sent to Meehan, Missouri Botanical Garden, and Orpet of S. Lancaster, Mass., and all report in 1896 perfect seed from pistillate plants. This seems to be a clear case of parthenogenesis. *T. dioicum* does not show a similar habit.

ELIAS J. DURAND: *A discussion of the order Pezizineæ of Schröter.*—A brief historical sketch giving the views of the principal systematists in regard to the classification of these plants, especially that of Schröter in his *Kryptogamen Flora von Schlesien.* The remainder of the paper deals with the most recent views and with a summary of investigations on the subject by the writer.

S. M. TRACY: *What should constitute a type specimen?*—The speaker called attention to the confusion existing in the use of

such terms as "duplicate of type," "co-type," "type locality," etc., and suggested that some action be taken looking towards an agreement as to what should constitute a type specimen.

F. C. NEWCOMBE: *Rheotropism and the relation of response to stimulus.*—It has been shown by Strasburger and Stahl that plasmodia of Myxomycetes grow against a gentle stream of water. Jonsson found three fungi and the roots of three phanerogams that also grew either against or with a stream of water. For this phenomenon Jonsson proposed the term *rheotropism.* As the work was left by Jonsson there was no indication of the extent of rheotropism among phanerogams, nor was it determined whether there were any negatively rheotropic, nor whether there were any indifferent roots, since the three species cited by this author were positively rheotropic.

The work which is reported in this paper has shown that among seventeen species of monocotyledons and dicotyledons studied eight are positively rheotropic and nine are indifferent or neutral. None have been found to be negatively rheotropic. Only seedlings were used.

The phenomena of rheotropism in roots are these. When seedlings are suspended with their roots dipping into water flowing with a favorable velocity, the roots, if positively rheotropic, will bend their tips, in the course of a few to several hours, directly or obliquely against the stream. Since the roots grow against the mechanical pressure of the stream and display a latent period and an after-effect, rheotropism is assumed to be a response to irritability. The stimulus for this response we can do no better at present than to call the flowing water. There may be some unwillingness to regard this as the real stimulus, seeing that the response to such a stimulus is difficult to interpret as being to the advantage of the plant. This brings up the general question of the relation of response to stimulus.

It is quite certain that there is a chain of causal mechanism between stimulus and the response which the stimulus sets in

motion. This mechanism has been developed by the reaction of the plant organ toward its environment. But it is almost certain that the mechanism may be started by other stimuli than those to which it has developed a special correspondence. If this be true we may look for responses in plants and animals that are not to their particular advantage. However this may be, the investigator is interested in all irritable responses, useful to the plant or not useful, for it is only by studying all phenomena that we may go a step farther toward solving the intricate problems of irritability.

HERMANN VON SCHRENK: *Some adaptations of shore plants to respiration.*—The paper treats about equally the following topics: (*a*) the different shore plants, classified according to proximity to water (aquatic plants are not considered); (*b*) the necessity of modified structure to meet new conditions; (*c*) the modifications thus caused in the form of water lenticels and the peculiar tissue, aerenchyma; (*d*) inconstant occurrences of the latter on many plants and reasons therefor; (*e*) discussions as to what the meaning of this power of adaptation in certain plants may be.

D. T. MACDOUGAL: *The mechanism of curvature in tendrils.*—The curvatures of tendrils in response to contact stimuli are due to contractions of the concave side. The coiling of free portions of tendrils is due to excessive growth of the convex side The two processes are entirely independent, and the second may be influenced to a minor extent only by the first.

EDWIN B. COPELAND: *A contribution to our knowledge of the relation between growth and turgor.*—The paper gives an account of the state of turgor of seedlings of *Vicia Faba*, grown at various temperatures, presented by means of a table. High turgor is present when growth is slow and *vice versa*. The turgor of *Lupinus albus*, normal, etiolated, and deprived of CO_2, is discussed. Prevention of growth is accompanied in this plant also by high

turgor and *vice versa*. The conclusion drawn is that the rapidity of growth regulated the amount of turgor, instead of growth being regulated by amount of turgor.

BOTANICAL CLUB.[3]

W. A. KELLERMAN: *Distribution of certain Ohio plants.*—With the aid of a map, attention was called to the distribution of *Phoradendron flavescens* through the southern counties, the northern limit broadly coinciding with the southern limit of the drift; of *Bignonia crucigera*, occurring only in Lawrence county, the southernmost county of the state; and of *Polypodium polypodioides*, occurring in two Ohio river counties, Adams and Hamilton.

L. R. JONES: *A method of distributing fungi in pure cultures.*—When leaves contain numerous fungi the distribution of dried material frequently leads to confusion. Cultures of the desired fungus are made in agar and sent in blocks with the dried material.

MRS. E. G. BRITTON: *An interesting moss from the White mountains.*—In a recent collection of mosses made by Mr. Faxon in the White mountains there occurred specimens of *Tetraplodon mnioides*. The moss is known in small tufts on other mountains, but occurs abundantly in the new station. Its abundance seems to be explained by the presence of the mountain stables, from which the dripping urine of the horses has furnished peculiarly favorable nutrition.

DAVID F. DAY: *The branching rhizomes of Iris.*—Numerous native species of Iris in cultivation had been observed, and in every case the rhizomes branched terminally into three divisions, the central one alone giving rise to the flowering stem. This habit is believed to be true of all American species of Iris, and of all species excepting the so-called bulbous forms.

[3] No formal papers are read before the Club, but the topics reported are presented informally and discussed.

C. E. BESSEY: *Distribution of Arctostaphylos Uva-ursi in Nebraska.*—The state was described as an almost treeless sloping plain, rising from the Missouri river at an elevation of 1000 feet to 5000 feet at the western boundary. Near the center of the state the bearberry was found a few years ago in a small cañon, and recently at a second station in a gorge of the bluffs of the Republican river at the southern boundary of the state These two isolated patches are widely separated from the present mass distribution of the species to the north and west. They are also noteworthy from the fact that ericaceous plants are notoriously absent from the whole region.

F. C. NEWCOMBE: *An improvement in a paraffin bath.*—Shrinkage of protoplasm when imbedding plant tissues often occurs when they are transferred from the cold saturated paraffin solution to pure warm paraffin. To enable one to make this increase in temperature gradual some device must be adopted to allow the imbedding dish to be lowered gradually into the bath. A brass spring bearing against the side of the pocket which receives the dish was suggested.

W. W. ROWLEE: *Notes on oaks.*—Specimens of oaks growing in the vicinity of Ithaca, N. Y., were displayed, showing (1) the habit of branching at the end of each annual growth, giving the characteristic appearance of rigidity; (2) a case of second shoot development during the present season, the winter bud having formed in June, and subsequently having developed its shoot; and (3) a remarkable case of leaf variation upon a single branch, giving the tree the appearance of bearing a branch of some other species.

C. E. BESSEY: *Distribution of Pinus ponderosa in Nebraska.*—The distribution of this pine in Nebraska has been given usually as occurring in two regions: along the northern border of the state down the Niobrara and up its cañons; and at the southwestern corner of the state along the Platte. It is now found

that the pine occurs in patches in cañons of the Loup in the center of the state, and also elsewhere, representing remnants of forests. A former extension eastward along the valleys was inferred, and their present bare condition was attributed to the destructive presence of man during the years of migration "across the plains."

L. H. JONES: *Notes on potato-leaf fungi.*—Cultures of *Macrosporium Solani* and inoculations with it indicate that it is not the cause of "early blight" or "leaf-spot disease," but is a true parasite. The cultures also proved it to be an *Alternaria*, and hence should be called *A. Solani*. What is known as "tip burn" was found to be associated with a fungus which proved not to be *M. Solani*, although usually confused with it. It produces alternaria chains, but the spores are smaller and more numerous in the chains than *M. Solani*. It is a saprophyte common to many plants and seems to be identical with *M. Tomato* Cke., which is certainly an Alternaria.

H. L. RUSSELL: *A method of hindering condensation of water in culture plates.*—Water is apt to condense upon the under surface of covers of culture plates, and dropping upon the surface of the culture plate causes more or less trouble. This can be remedied by placing the culture plate with its cover within a bowl covered by another bowl a little smaller.

C. E. BESSEY: *Notes on the flora of Colorado Springs.*—Attention was called to five distinct plant societies which occur in the region of Colorado Springs, and which abut closely upon each other with sudden transitions. The habitats of these societies are: (1) the plains; (2) open dry mountain ridges and summits; (3) deep cañons, in the lower stretches of the mountain elevation; (4) mountain meadows, at a greater elevation than the cañons; and (5) mountain swamps, usually lying between the meadows above and the cañons below. Rapid changes are taking place in the flora of the region, in explanation of which three

causes were suggested as follows: (1) removal of forests by fires, etc., thus denuding the slopes; (2) the consequent opening of cañons to light, changing dark and damp conditions to those which are open and dry; and (3) vandalism of tourists, in the cañons especially, which have been ravaged, notably of ferns.

E. J. DURAND: *On a species of Epipactis.*—Upon a lawn in the village of Canandaigua, N. Y., *Epipactis viridiflore* suddenly made its appearance, although careful search of the whole region has failed as yet to discover it as a plant of the local flora. In the same connection Mrs. E. G. Britton called attention to a similar sudden appearance of *Arisæma Dracontium* in a garden upon Staten island, although not known to occur wild anywhere upon the island.

C. L. POLLARD: *Report of the National Herbarium.*—The new organization of the herbarium consequent upon its removal to the National Museum was explained. The customary appropriation of $25,000 to the Division of Botany had been reduced by the last legislature to $15,000. The necessary relief was then obtained by an additional appropriation of $10,000 upon the condition that the herbarium be placed in the care of the Smithsonian Institution. Mr. Coville is appointed honorary curator, while the staff directly connected with the work at the National Museum consists of J. N. Rose, in charge of the determination of the higher plants and the work upon the Mexican flora; O. F. Cook, in charge of the cryptogamic work; and C. L. Pollard, in charge of the mounting and distribution of material.

E. G. BRITTON: *Note on Schizæa pusilla.*—In 1879 Mrs. Britton made the first announcement of the discovery of this rare fern in Nova Scotia. During the present season she has received additional specimens of it from Mr. Waghorne.

K. M. WIEGAND: *Notes on Boschniakia.*—Studies of Tacoma material of *B. strobilacea* revealed characters not provided for in

the generic description as it appears in the Synoptical Flora. The linear subulate bracts, and the two lateral calyx teeth are the notable discrepancies. Examination of *B. glabra*, the original species, showed that the generic description was constructed for it, and had not been modified so as to include *B. strobilacea*. Discrepancies were also pointed out in the section characters of the genus.

C. R. BARNES: *Photosyntax* vs. *photosynthesis*.— It was stated that the word photosyntax, proposed in 1893 by the speaker, but objected to by Professor MacMillan as etymologically bad, had been resubmitted to three competent Greek scholars and pronounced by all to be linguistically unobjectionable and accurately expressive of the process of carbohydrate formation as now understood.

J. F. COWELL: *Notes on some hybridized sunflowers*.— Ordinary flowers of *H. petiolaris* had been pollinated from some "doubled" *H. decapetalus*. Seedlings were shown which presented complete intermediate characters.

E. G. BRITTON: *Mnium Roellii* Broth.—The synonyms of *Bryum lucidum* E. G. Britton were explained, of which the last is *B. Sandbergii* Holzinger.

C. E. BESSEY: *The cañon flora of the plains of Nebraska*.— The cañons occurring in the general plain surface were described. Up to the very brink of these cañons sand-loving plants are found, but within the cañons they are suddenly replaced by moisture-loving plants, representing a totally different flora. The strong invasion of plants from the Rocky mountain region has, therefore, resulted in two types of incursion, that across the sandy plains, and that within the cañons. The invasion of eastern plants is observed to have a similar two-fold expression. The cañon plants are not necessarily cañon plants at the west or east, but are simply moisture-loving.

E. B. COPELAND: *Turgor variation in mosses.*—The turgor variation in relation to temperature was specially noted, being in general greater in mosses than in other groups. Plasmolysis was used as the test of turgor. It was shown that in *Mnium cuspidatum* the accommodation to changed temperature was dependent upon the products of assimilation; while in *Funaria hygrometrica* it was proved that this was not the case.

A. P. ANDERSON: *A simple piece of apparatus for infecting and spraying plants.*—A syringe of peculiar structure, such as artists use in "finishing off" paintings, was suggested, as being a better distributor than the ordinary apparatus.

E. J. DURAND: *Structure of pseudo-parenchyma.*—The method of the transformation of ordinary hyphæ into pseudo-parenchyma is easily observed in its simplest form in Tubercularia. In Peziza it is not so evident, but gradual transition can be traced clearly. In general there is a rounding off of the cells of much septate hyphæ, and sometimes a coalescence of the cells of contiguous hyphæ.

HERMANN VON SCHRENK: *Notes on the hosts of Comandra umbellata.*—This plant is by no means always a parasite, but when it is such it is assumed to be an ericaceous parasite. While most commonly attached to species of Viburnum, the speaker had found it upon *Potentilla Norvegica*, *Solidago Canadensis*, and *Phleum pratense*. Attention was called to the fact that attachment does not always mean absorption, and this is notably true in the case of a grass host.

CONWAY MACMILLAN: *Function of the submerged leaves of Salvinia.*— The hairs upon the submerged leaves have been considered usually as not organs of absorption. The speaker had observed that when exposed in water containing small crustacea, etc., the sharp-pointed hairs, standing out in every direction, are avoided. It was suggested that the hairs, therefore, may be

largely protective organs against predatory insects. They may serve also as a sort of counterpoise in high winds, offering resistance.

CONWAY MACMILLAN: *Nuclear budding in Cypripedium.*—The speaker had noted a peculiar fragmentation in the nuclei of the basal cells of the hairs. The process can be indicated best by the term "budding," as it seems to be a gradual outgrowth from the surface of the nucleus with final separation.

CONWAY MACMILLAN: *Adaptation of Coniferæ to wind-swept stations.*—In his studies of the flora of the Lake of the Woods the attention of the speaker had been called to a group of white pines which were not growing in the usual manner in rock crevices. In addition to the high branches a circle of branches flat upon the rocks had been developed, forming a dense circular mass, after the manner of a juniper. This was interpreted as an adaptation to a high wind-swept position, and shows that a forest plant may assume the juniper habit.

FLORENCE BECKWITH: *Plants new to the flora of Monroe county, N. Y.*—Since the recent publication of the Catalogue of the Rochester Academy of Science several plants new to the flora have been discovered.

EDNA M. PORTER: *Note on the pollination of Epipactis viridiflore.*—It was shown that the plant is pollinated by the wasp *Vespa diabolica.* In Europe, according to Darwin, *V. silvestris* is the pollinator. Plants covered with a netting set no seed. The observations were illustrated by an ingenious mechanical chart, *à la* Gibson.

E. B. COPELAND: *Turgor and unused residues.*—In all normal roots, stems and leaves there is a large residue of osmotically active matter which the plant cannot use to postpone starvation. In these organs the nutrient matter is relatively unimportant. In the storing places of dissolved food, however, this element

in the turgor sometimes dominates; but here, too, a considerable unused residue is usually encountered.

A. P. ANDERSON: *Supposed pathological condition of a pine board.*—The speaker displayed a board whose appearance was supposed to indicate a fungus attack, but explained that the appearance was due to the remains of the "short shoots."

EMILY GREGORY: *An interview with Schwendener.*—The speaker described an interview with Schwendener concerning the views of Reinke upon the nature of lichens, in which Schwendener is reported as saying that Reinke's views differ in no essential respect from his own.

JOHN M. COULTER: *Cross-fertilization and heterospory.*—Attention was called to the danger of confusion in applying the terms close-fertilization and cross-fertilization to heterosporous plants. Close-fertilization, strictly defined as the fusion of gametes produced upon the same individual, cannot occur in heterosporous plants. Heterospory necessitates cross-fertilization, and the closest possible affinity is that of two gametophytes borne upon the same sporophyte. In seed-plants, therefore, we find close-pollination and cross-pollination, but only cross-fertilization. The significance of the flower, therefore, is not to bring about cross-fertilization, but to render more distant the relationship between the two gametophytes concerned.

E. G. BRITTON: *The mosses of R. S. Williams.*—The speaker announced that collections of the mosses of the Columbia region of northern Montana were being made by R. S. Williams, and commended his work to the favorable attention of botanists Sets for sale will be ready soon.

W. A. KELLERMAN: *An index card for local herbaria.*—A card was exhibited upon which was printed an outline map of Ohio, which could be variously marked to indicate the range.